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Strategic management of the Romanian Health System based on Boehm model: a conceptual framework

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Abstract

Strategic management of the Romanian healthcare system could be a solution for the numerous problems Romanian contributors (and, of course, non-contributors) face when they need medical care services. This paper will review present challenges and the current status of the system in Europe and Romania, as well as the stage of implementing the principles of corporate management. It will also discuss the specificities of health care and the arguments for a certain approach of the system's strategic planning. Based on these observations, a model of strategic planning will be suggested, considered the best under the circumstances: the Spiral Model, introduced by Boehm in 1986 as a model for software development. We will justify the selection of the model and highlight the main issues which must be considered when grounding the strategy for the Health Sector, having in mind that, because the problem is multidimensional, the solutions should also be multidimensional.

Keywords: Strategic Planning of the Healthcare System; Spyral Model; Strategic Performance Level

JEL classification**: I18, H8**

1. Introduction

Almost any public discussion concerning the public sector and the public services in Romania concludes that the main cause of the lack of effectiveness in this sector is the underfunding. Considering that financing resources are not growing as fast as needed, a logical conclusion one could draw is that the bankruptcy of the entire public system is a matter of time and nothing could be done. One of the most "visible" and, in the same time, critical

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services for the general welfare of the population, the healthcare system, is in the same situation or even worse, if we only consider that the population is growing older and, while the primary education system addresses a smaller number of beneficiaries each year, the demand for the healthcare services is continuously growing. The aim of this paper is not only to prove that, with a proper political volition and good management, the health care system can survive, but also to propose some ways to achieve this.

Our approach starts from several statements proven to be correct in similar cases. One of them is: "if a reliable solution is found, the financing could be assured". Therefore, we believe that the main cause of the health care system decline is not the lack of funds, but the misuse of the existing ones. Another hypothesis we base our research on is that there is not only one problem of the health system, but several of them, for each social group, region or type of disease. It is obvious that it is not possible or correct to set providing of high level medical assistance both to the contributors to the medical care budget and to the non-contributors as the main goal, even if this is against some political beliefs. Thus, in our opinion, the assurance of a minimum of services for the disadvantaged categories and an average for the majority of the contributors is a fair target.

Another observation we will rely on is that the system should change in an intelligent way, which means that no one should expect a one-step, total turn from low effectiveness to high performance, but a longer, iterative, transformation.. The iterative process will take into account the response of the economical, social and political environment to the stages performed and refine the objectives for the next steps according to this reaction. This is why we suggest a spiral model, similar to some extent to the one introduced by Boehm in 1986 (Boehm, B. 1988).

Therefore, we will present a continuous and iterative approach for design, implementation and development of the Romanian healthcare system. It is a holistic rather than a punctual view which does not focus on institutional, tactical actions but on a coherent, continuously improving strategic process meant to increase the quality of public services, building each new step upon asserting the reactions of the social environment and the risks identified after the previous stage.

2. Literature review

Several monitoring or expert groups in the European Union developed foresights (as, for example, The European Foresight Monitoring Network- EFMN) for the future evolution of health systems in the next 15-20 years. Seen as a part of the European society, the health care services definitely influence the wellness of the Europeans, but also the European research and therethrough the innovation policies. This is why the reports issued on this theme have not only a social or technical component, but also different dimensions as, for example, financial or ethical (The European Foresight Monitoring Network. 2009).

A projection of this vision on the health care future in Romania brought into discussion several aspects which must be taken into consideration when elaborating the strategy for this field as, for example, the discrepancy between different regions of Romania, which refers both to the medical infrastructure and to the potential of the economy, local government or population (Agentia de Dezvoltare Regionala Nord-Vest. 2008). We can also find significant differences inside the same region, between different counties. Another aspect is the implementation of the DRG (Diagnostic Related Group) system, which has been being implemented in Romania since 2000 (SNSPMS. 2012). The system, developed in the 1970's at the University of Yale, has been used in a large number of countries. The good practices and also the bad experiences recorded in Romania and in other countries should be used in the process of strategic planning (Cash, R. 2009),(Keeler, E. 1990).

The strategy-planning methods we propose largely draw on some guidelines indicated in a report developed by the Health, Nutrition, and Population Family (HNP) of the World Bank's Human Development Network (Bradley, E., Pallas, S., Bashyal, C., Berman, P., & Curry, L. 2010). Even if we speak about strategy and corporate management in the public sector, we will support our model with a development philosophy, first introduced in the field of software development by Barry Boehm 1n 1986 (Boehm, B. 1986): The Spiral Model of the software process. As described by the author, we speak about an "evolving risk-driven approach" (Boehm, 1988), which states that development of a complex system as, for example, a software application or, in our case,

a multidimensional system as the health care, cannot be done from beginning to end in one step but in successive iterations, each of them bringing results and consequently upgraded demands. The model is treated in an extended form by Cockburn (Cockburn, A. 1995), who states and demonstrates that **incremental development** is "a scheduling and staging strategy that allows pieces of the system to be developed at different times or rates and integrated as they are completed.".

3. Methodology

The structure of this presentation is typical for the papers describing proposed ways to improve different fields, areas or activities: description of the main problems, illustrating the problems by reports and data from either primary or secondary sources, presenting several choices the decision makers have and indicating the one we consider (and demonstrate) to be the most appropriate.

Since - as shown in the Introduction - we are discussing the nationwide actions to be undertaken and not the solutions at the medical unit or regional level, the data and information used for supporting our approach is of secondary nature, found in official reports from different sources. The only empirical data we use in our exposure refers to the beneficiaries' or staff's qualitative perception of the outcomes and the processes specific to the domain. Consider that any statement of this nature presented in the paper reflects the opinion of a larger number of people, regardless of the sample being explicitly described.

Because we suggest applying of some theoretical constructions, proven as valid solutions in a different field (as computer programming), in one of the first paragraphs of this work we will try to show that health care service planning process and software development resemble in the fundamental aspects, as purpose or approach. Some of the paragraphs of the paper contain ideas and statements that, if developed, could lead to valuable theoretical and practical results. We will also try to emphasize the directions we intend to extend the research to, in order to get a clearer image of the phenomenon studied in this paper or to get closer to effective, applicable solutions in the health care planning.

4. The actual status and problems

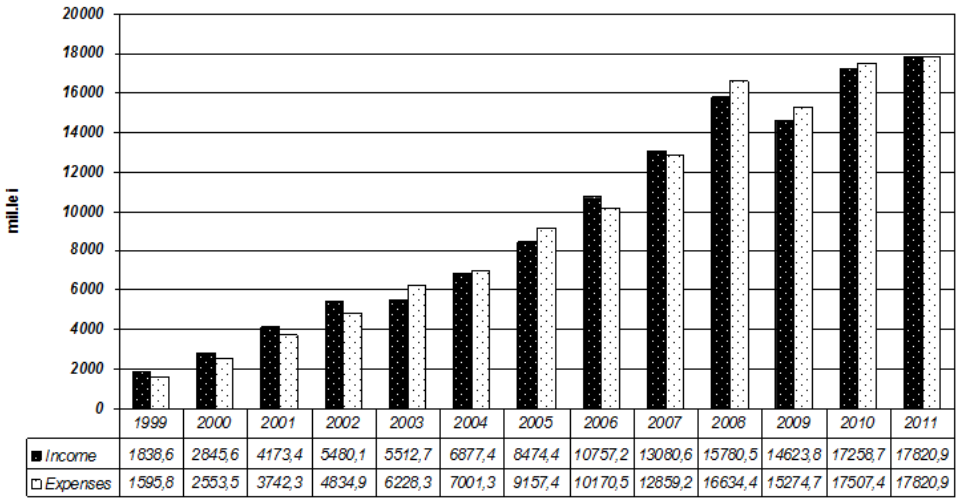
4.1 Healthcare in the EU Trends

Even that in some member states of the EU there is a rich bibliography and a high experience concerning the healthcare services and the healthcare system, the last decades faced the necessity of reformulating the main problems, the new principles and a modern approach for developing the system. In 1973, Barbara Starfield stated that there are four major determinants of the health-services performance (Starfield, B. 1973) and they are the genetic makeup of patients, their behaviour, the medical practice and the environment. Showing that the medical practice consists in two main categories of elements - the structural ones (like the system financing, the form of organization or the staff), and the functional ones, for example diagnosis and therapy – she defines the care process as being the interaction of the functional aspects of medical practice and of the behaviour of patients. She concluded: "A formulation of health-services research along these lines permits an integrated view of structure, process and outcome, as well as taking into account physician-patient interaction."

A new concept – healthy ageing – was introduced and became a logo for many of the national health systems. It mainly replaces older life-quality measurement indicators as, for example, Life-expectancy, with more complex ones- Healthy Life Years or Disability Free Life Expectancy, which are expressed in the number of years a person who lives in a specific region is expected to live in a non-limitative health condition. It gives birth to several challenges such as proper management of the economic balance between contributors and beneficiaries, changing the labour market into a labour structure consisting a larger segment of elderly people and providing pensions for the retired people. Another challenge concerns globalization, population mobility and regional competitiveness. It is obvious that the connection between population and territory is weaker and weaker.

4.2 Romanian reality and past experiences

The target of this paper – the Romanian health care system – inherits the problems and challenges of the European one and adds a lot of others, specific to the country and the geopolitical region Romania belongs to. As we know, the communist era set up a health system based on social accessibility and equal treatment of the citizens, or at least these were the stated defining principles. It was financed from the national budget, which was predictable and planned on a five-year basis, together with all the other sectors of economy or social assistance, the resulted plan being compulsory (imposed by law) for everybody. We do not intend to debate how this system worked, but to show that none of its existing conditions have been maintained until today. As a main consequence, *the structure of the health system must be totally redesigned* which is definitely a long term, strategic process. This is the main causes for which in the last two decades the health care system has been a hybrid, at least in terms of resources. It means that the health contributions have been collected to a central fund, administrated by the government, who has decided upon allocation, and established an upper limit of expenditure always lower than the amount collected. This has caused a continuous crisis with some severe situations, such as the late reimbursement by National Health Insurance Office of the expenditures with compensated medicines. The independence of the Health Insurance Fund from the Ministry of Finance has increased since 2003 (excepting 2006 and 2007) but the continuously growing expenditures with the health services became a heavy burden for the government, as shown in Figure 1.



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Income	1638,6	2845,6	4173,4	5480,1	5512,7	6877,4	8474,4	10757,2	13080,6	15780,5	14623,8	17258,7	17820,9
Expenses	1595,8	2553,5	3742,3	4834,9	6228,3	7001,3	9157,4	10170,5	12859,2	16634,4	15274,7	17507,4	17820,9

Fig. 1 The Evolution of the National Health Fund between 1999 and 2011
Source: The National Health Insurance (Sanatate, 2012)

In fact, as shown by Eurostat statistics (Eurostat. 2012), health is the second largest function of government spending (after social protection) at 7.5% of EU GDP in 2010 (14.7% of total government expenditure). Compared to that, the share of the total government expenditure in Romania is, according to the above cited organization, 3.6% in 2010, less than in 2002 (4.1%). As seen in the above chart, the funds allocated for health care are almost ten times higher in 2011 than in 1999 and they doubled compared with 2005. What both people and specialists agree on is that the services' levels are not higher than in 1999, even though some of the hospitals have been upgraded. Some units, considered to be ineffective, were closed in 2010 and 2011. The income of medical personnel decreased in real terms and lots of doctors and nurses left Romania for other European countries, where they were offered much better wages, causing a severe shortage of medical staff in Romanian hospitals. A conclusion drawn from all these observations is that while the government allocation for medical

services can only raise insignificantly, there is no chance, keeping the current evolution, to satisfy the needs of the population. *There must be a shift in the way the money is spent. The resources must be managed in an effective and efficient way, the same they are in the corporations.*

In the last 20 years the changes in the public health services have been made due to the overall and individual interest of the leading political force and this is why no coherent strategy was followed. In our opinion (reached after consulting specialists or simple beneficiaries of the health services) there are very few chances that the situation can change. What we consider to be the best way to cope with this situation but also to have a strategic planning of the system is a spiral (iterative, tornado) approach, which means that every four-year period can be a step to a desired stage, chosen for the Romanian health care system to be reached in the future.

At the same time, the long term commitment must have a wider scope and take into account several neighbour and related domains such as the social security system (healthy ageing implies a shift of the actual paradigm for social care and active persons' health care), the state-funded medical research or pharmaceutical research. Taking into consideration the above observations, the strategic planning of the Romanian health system can be synthesized in the following way: ***An iterative approach consisting of tactical steps of 4-6 years (the estimated average lifetime of a Romanian Government mandate) oriented to reaching a strategic objective, which could be expressed in terms of a multidimensional variable (state) readjusted after every step.***

5. The proposition

5.1 Computer programming, policy making and strategies: strongly related activities

Except some projections of the concepts “policy” or “strategy” to the current development processes of the computer architectures and software systems, it seems it was not much attention paid to the similitude between writing a software program or finding out an algorithm on one hand and establishing a specific policy on the other hand, nor was studied the parallelism between building a strategy and a software system dedicated to a complex activity. We consider that the resemblance of the goal setting process and current activities run in order to fulfil the objectives in the computer programming and policy making is strong enough to let us adopt different findings in computer programming to strategy and policy making in the healthcare services and, up to some extent, in all planning processes. Even if the three terms came from different areas of science and have occurred at different times, triggered by different events, even if, while computer programming seems to have a meaning only in connection with computer hardware and infrastructure, policy making is, by default, connected with people and society, the processes themselves are very similar, both from the point of view of what they try to achieve and because the way they run. Speaking about the finality of the two processes mentioned above, there is a common result they try to achieve: a clear description of the steps that something (a machine) or somebody (a person holding a certain position or a group of people) must follow in order to achieve a certain state, connected with a set of results and state indicators. Every step has a double impact, as it is performed: getting closer to the final, desired state and also modifying the context or the environment. In both cases, the clarity, universality, finitude and the other characteristics of the algorithms must be assured to the final description, so that any machine (for a given software application) or person (for, let's say, a given policy in the health care system) should get to the same type of result after following the steps. Both the strategy/policy making and the computer program system depict actions to be taken at different moments in time and under specific circumstances. Foreseeing has a main role and simulation is also very important.

5.2 The five blocks of the World Health Organization (WHO)

Strategies, no matter the domain they are formulated and applied to, are all developed in order to reach a desired state during a time interval (normally a few years). In this context a *state* can be seen as a complete set of values for all the relevant state variables, measured at the same time, at the final moment of the strategic horizon. A relevant state variable is any measurable (quantitative or qualitative) property of a system or entity (in our case,

Health System) which, from a specific point of view, describes the situation of the system/entity at a certain moment in time. Mathematically, if we consider a number of n aspects which describe the system exhaustively (A_1, A_2,…,A_n), each of them being expressed by a number of state variables (specific properties defining each aspect)- m1 variables for A_1, m2 for A_2, … , mn for A_n – we could say that v_{11}, …, $v_{m1,1}$, (all of the m1 variables which define A_1) together with v_{12},…, $v_{m2,2}$ (for A_2) up to $v_{1,n}$…$v_{mn,n}$ (for A_n) are the state variables describing a state of the system by their values recorded at the same time t_0. So, the state of the system at t_0, named from here on $S(t_0)$- the desired state at the future moment t_0- is:

$$S(t_0) \equiv (A_1(t_0), A_2(t_0), ..., A_n(t_0)) \quad (1) \text{ or}$$

$$S(t_0) \equiv (v_{11}(t_0), ..., v_{1,m1}(t_0), v_{21}(t_0), ..., v_{2,m2}(t_0), ..., v_{n,1}(t_0), ..., v_{n,mn}(t_0)) \quad (1')$$

In (World Health Organization. 2007) the authors introduce five aspects which, on their opinion, can In (World Health Organization. 2007) the authors introduce five aspects which, in their opinion, can exhaustively describe the state of a health system, named blocks (or building blocks) of the health care systems: service delivery (we will assimilate it with A_1 introduced above); health workforce (assigned to A_2); information; medical products, vaccines and technologies (A_3); financing and leadership (A_4) and governance or stewardship (A_5).

Another point of view is the one expressed in the paper prepared for World Bank, Washington DC., USA (Bradley, E., Pallas, S., Bashyal, C., Berman, P., & Curry, L. 2010) where the metrics for each of the domains are also presented. There are six core performance domains more or less similar with the building blocks of the WHO: quality, efficiency, utilization, access, learning, and sustainability, we can assimilate with A_1 to A_6, each of them containing two to six dimensions (Table 1).

Table 1: Domains, dimensions and metrics of a Health System

DOMAIN	DIMENSION	METRICS
QUALITY	Clinical quality Management quality Patient experience	• Adherence to clinical guidelines • Avoidance of medical errors • Availability of medical supplies • Functional medical records system functional • Patient satisfaction
EFFICIENCY	Cost-to-service ratios Staff-to-service ratios Patient or procedure volume	• Nurses or health workers per bed • Inpatient or outpatient visits per day, per bed, or per health worker
UTILIZATION	Patient or procedure volume relative to capacity Patient or procedure volume relative to population health characteristics	• Percent occupancy • Outpatient visits per provider • Percentage of pregnant women receiving antenatal care
ACCESS	Physical access Financial access Linguistic access Information access Service availability / allocation Non-discriminatory service provision (equitable treatment regardless of age, gender, race, ethnicity, religion, etc.)	• Geographic distance to facility • Availability of transport to facility • Hours of operation of facility • Absenteeism of health care workers from facility • Affordability of services • Availability of culturally and linguistically appropriate services
LEARNING	Data audit and feedback processes Innovation adoption	• Use of balanced scorecard for organizational performance • Presence of patient suggestion box

	Training/continuing education for healthcare workforce	• System exists for nurses to report errors to hospital management • Quality improvement methods used
SUSTAINABILITY	Political support Community and patient support Human resource supply Staff commitment Strategic planning	• Involvement of community leaders in facility planning • Use of strategic management process to promote organizational fit with environmental conditions • Robust connection with health workforce educational pipeline

Source: (Bradley, Pallas, Bashyal, Berman, & Curry, 2010)

As seen, for each of these dimensions there can be defined metrics for describing different aspects considered to be definable for the dimensions. Unlike WHO paper, the research work mentioned is more focused at the organizational level than the national one, even that the authors state that their model is also applicable at the macro levels. Because this paper is focused on macro-level health systems rather than facility-level health services, most of the further references are centred on WHO model. Having these notations, we can say that the strategic goal of the Romanian Health System for 2020, expressed in terms of WHO blocks is:

$$S_{RO}(2020) \equiv \left(A_1(2020), A_2(2020), A_3(2020), A_4(2020), A_5(2020)\right) \quad (2)$$

Of course, each of the A_1 to A_5 consist of a number of specific variables (some of them usual indicators for the medical care, such as the number of hospital beds inside A_1 or the available funds for the system in A_4).

The national health services' strategy must, in our opinion, define the desired state (main objective up to a certain year) in a similar form with (2) while different stages of fulfilling (we suggest 4-6 years in average) should set up objectives expressed as (1').(Assessment 1)

In order to have a coherent image of the condition of a health system, A_1 to A_5 can be measured by scales with the same number of steps, such as points between 1 and 100 or, more general, colours. Of course, a detailed analysis of each of the blocks can demand values for the variables contained by any A_i. We could then generate different types of charts for a specific year and have different suggestive views about the evolution of the health system in a certain country or comparisons between different systems or aspects. We will also have different approaches for fulfilling a desired level for the blocks, expressed in what we had been calling "strategies" before long ago. Having said that, we will present a model proposed by Barry W. Boehm.

5.3 The Boehm Spiral

In 1986, Barry W. Boehm, TRW Emeritus Professor of Software Engineering at the Computer Science Department of the University of Southern California, published an article (Boehm, B. 1988) introducing a relatively new iterative model for complex software systems development, also known as "the spiral life cycle model"(Figure 2). The steps (iterations) in the spiral model can be generalized and we obtain a sequence of actions starting with defining the system requirements in a detailed manner (this usually involves interviewing a number of beneficiaries, both internal and external), requirements that represent all the external or internal users and other aspects of the existing system. A preliminary design is created for the new system. A first prototype of the new system is constructed from the preliminary design. This is usually a scaled-down system, and represents an approximation of the characteristics of the final product. A second prototype is evolved by a five-step procedure (Figure 1): (1) evaluating the first prototype in terms of its strengths, weaknesses, and risks; (2) defining the requirements and setting the objectives for the new iteration; (3) identification and analysis of the risks and of the methods to mitigate them; (4) designing of the current stage of the system and (5) implementation and delivery.

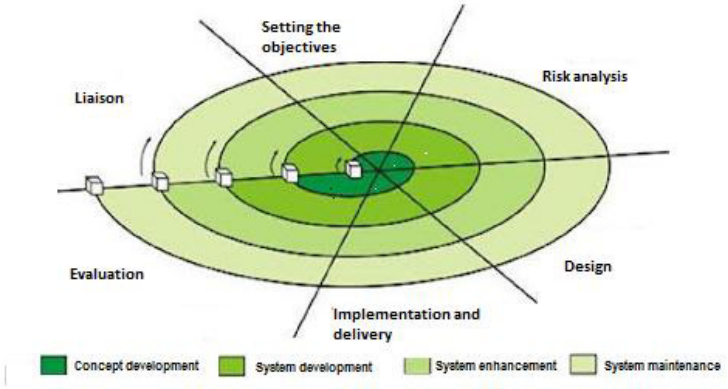


Fig. 2. The stages of the Boehm Spiral Model
Source: (http://robincse.blogspot.ro/2012/03/boehms-spiral-process-model.html, 2012)

The model we suggest for the strategic planning of the health system is based on what Boehm suggested but the representation we propose is a tridimensional one, with the vertical axis representing the **strategic performance level,** or the overall "height" of a national health care system, measured in terms of weighted average of the performance level achieved by the system at each block $A_1..A_5$ and conceptually represented by a surface (plan) as in the Figure 2.

5.4 The strategic performance driven spiral

Any full cycle of the Spiral in the model **above** can be seen as an iteration on the way to improve a certain situation towards a desired level. Each of those iterations could be described in terms of time (duration), costs recorded and gain in performance. Each cycle can have as main goal improving of one or more variables - $v_{ij}(t)$ in (1') - which means that after several iterations, after some time, at a determined cost, $A_i(t)$ has been reached. Ai(t) represents a strategic level for A_i recorded at the moment t, and is an intermediate level between $A_i(t_0)$- the value of A_i at the beginning of the planning period and $A_i(t_s)$, with t_s nominating the strategic horizon. As we tried to describe in Figure 3, this can be seen as a transition between two so-called "plans", each of them determined by the strategic performance level reached through the blocks $A_1..A_5$. At some extent, the transition between a lower strategic performance level and a higher one can be equated with a change in the potential energy of a system as a result of consumption of an "equal" amount of kinetic energy of the iterations (cycles) performed in order to reach the strategic performance level.

Several observations have to be made in order to clearly understand the analogy between the progressive process in the health care systems and the graphical models presented. One of them concerns the term "plan" and the fact that, like in the classical geometry, five points located in a tridimensional space do not always uniquely determine a plane. This means that between two systems (either national or conceptually different) characterized by the same $A_1(t)..A_5(t)$ can be differences in current representative features; they are "equivalent" in terms of overall performance but not identical (or, maybe, not even resembling in structure or functionality).

In Figure 3 we tried to represent the "plans" using curved lines in order to show that we do not mean plans in the geometric acceptance, but, as shown above, in a more metaphoric sense.

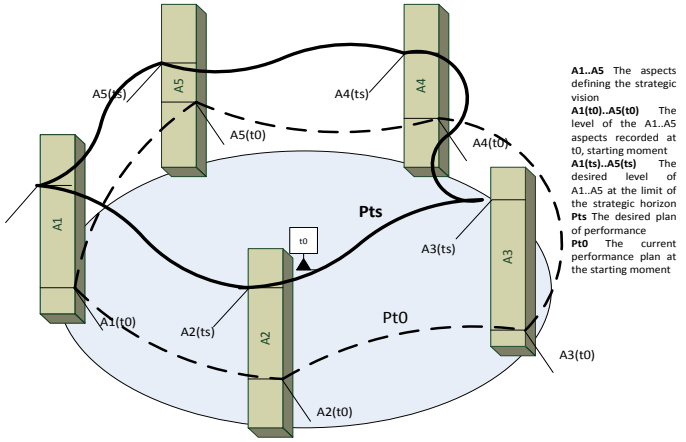


Fig. 3. Strategic performance levels
(Authors' interpretation)

Another important observation is that a certain level for one of the blocks can mean different values for the specific state variables in different systems situated at that level. Supposing that the level of strategic performance for the blocks is conventionally measured in points from 1 to 100, we can identify for, let's say, A_4 (financing and leadership) two different systems with 60 points. One of them could have implemented, let's say, the Diagnostic Related Group (DRG) in a performance manner, but the quota for the health system in the GDP is not as high as for the other one, while the second system has a higher funding but the leadership or the methods of determining the costs for the medical act are not so evolved.

The state variables contained in the 5 blocks can also be relevant (directly or by influencing other specific variables) for other sectors or related domains, as for the social care system or the local policies. At the same time, these variables could be modified by those domains, affecting, one way or another, the targets of the health system. Although we will not develop the integration capabilities of this approach in the present paper, it should be said that the health system, as presented in Figure 2, can be easily considered as a part of a larger picture, with hundreds of blocks and, maybe, thousands of variables.

5.5 *The strategic management versus strategic planning of the health system*

As shown above, whenever a new government went in charge (and, in the last 24 years, it happened many times) everything concerning the direction and the route of the health system evolution was changed; a new strategy was delivered, preparations started and, sometimes before the resources were identified, the strategy was abandoned: another government came or some other priorities occurred. This is what happened in Romania, but the problem is more general. As a matter of fact, it seems that the significant changes in the social or political environment are faster than the ability of the health system to adapt to those changes. In (Swaine, L., Duncan, W., & Ginter, P. 2008) the authors start from the serious difficulties health care has in "dealing with a dynamic environment, holding down costs, diversifying wisely, and balancing capacity and demand" and prove that "strategic thinking, strategic planning and managing strategic momentum" as components of the strategic management process are, all together, the key to a successful approach. Yet the main difference between the strategic planning and strategic management of the health care services is the adaptability and the elasticity of a long term plan in order to take into account the environmental changes and to reformulate some of the objectives due to these new realities whenever necessary.

This is the main point of the approach we suggest in this paper and the idea of the model described above. The main, long term goals, stated in connection with the desired level of A_1 to A_5 should be the only fixed milestones on the road to a better health system; all the other secondary objectives should be formulated for

shorter periods, cycles or iterations, limited in time to 1-3 years, and seen as intermediary steps in achieving the long time goals.

The environmental analysis, as presented in (Swaine, L., Duncan, W., & Ginter, P. 2008), has a crucial role in identifying the signals of the future environmental changes and to classify and organize the general and specific issues generated outside and inside the health care system. Service Area Competitor Analysis is another must for the iterative process, as it is for common corporate management processes. We need to understand that the main resource we can rely on for the development of the health system is the outcome of the system itself and to treat health service providing as any other commercial transaction. Medical tourism or the globalization of the social insurances in the European Union are two examples of situations we must take into account when we plan the national or regional health system.

6. Conclusions

In this article the authors wanted to emphasize that, before establishing a development strategy or a set of policies, before passing sets of laws regulating different aspects of the health care services, it is necessary to set up both a long-term and a medium-term approach. Considering the particularities of the health system in general and the specificity of the Romanian health care services, such an approach could rely on resemblances between strategy and policy making process, on one hand, and design of a complex software system (as, for example, an operating system or an ERP) on the other hand. The iterative method, introduced by Boehm (The Spiral Method) is particularly fit and it has proven its effectiveness, having features which recommend it for being applied to the planning of the health care system at macro level. Its main characteristic is that it describes a strategic management approach rather than a strategic planning one, making it a proper instrument for the strategic development of the health system. This paper is designed as a conceptual framework; actual methods, presented as algorithms, mathematical models or other proper descriptions are to be made. The authors have already started the research process to identify some of them.

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